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Regulatory Alchemy: How the Water Cycle Becomes Capital in the California Desert

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Abstract: A proposed project will take water from an aquifer in the California desert to the coast. Lacking final approvals more than thirty years after it started, the project remains a plan despite sizeable opposition. What is its secret? In this paper, I examine the imaginaries of the underground aquifer underneath the lands of Cadiz Inc, the project proponent. While local theories insist the company is at the center of a *Chinatown* conspiracy, I argue that the company stays alive through regulatory alchemy, a term that reveals the magic at the heart of scientific and regulatory approval processes. I examine narratives of the aquifer in environmental compliance and financial reporting in order to reveal how regulatory processes become the conditions of profit-making, building on debates in critical legal geography and political ecology.

Abstract for public (150 words): A proposed project will take water from an aquifer in the California desert to the coast. Although the project still lacks final approvals more than thirty years after the first proposal, it remains a plan. In this paper, the researcher investigates how regulatory alchemy—a term used to describe how companies create something from nothing in their environmental processes to portray their projects as both scientifically sound and financially investable. In the case, Cadiz Inc, the project proponent, creates an imaginary of nature that is scientifically unrealistic, but approved under regulatory processes. This process allows them to keep the project alive. This research helps to explain the relationship between scientific knowledge and regulatory processes for extractive projects.

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Regulatory Alchemy: How the Water Cycle Becomes Capital in the California Desert

“When he came back from the Cadiz tour, he seemed infatuated with the project. I asked him if he drank the water.” Mike, an elementary school teacher, recounted his friend’s visit to Cadiz Inc’s citrus orchard and vineyards in the East Mojave years earlier. The tour had been organized by Transition Joshua Tree, a permaculture group. They were looking for inspiration from the farm, even as some of the members in attendance opposed Cadiz Inc’s proposed groundwater extraction project. Several Cadiz representatives, including a geologist and public relations specialist, had led the tour. Mike suspected that his friend had fallen for the company’s sustainable language about the farm, when the company’s real plan was a groundwater project that would take desert groundwater to the California coast. His suspicion that his friend drank the water wasn’t necessarily about the water’s quality; instead, it was a concern that his friend had fallen for Cadiz Inc’s marketing pitch. Drinking the water, he argued, was believing Cadiz Inc’s narrative.

When he told me this story, Mike and I were attending a “Mappy Hour” hosted by the Mojave Desert Land Trust (MDLT), a semi-regular event when twenty or thirty Morongo Basin (Yucca Valley, Joshua Tree, and Twentynine Palms) residents would squeeze into MDLT’s all-purpose meeting room in Joshua Tree, California to learn about a theme. The theme of this hour was nominally “Water in the Desert,” but the meeting focused on a more specific issue: Cadiz Inc’s proposed groundwater project.

Cadiz Inc, a natural resources company, is the largest private landowner in California’s eastern Mojave. They own 45,000 total acres (34,000 of which are in the Fenner Basin) (Cadiz Inc. n.d.b). Much of their land is checkerboarded—that is, Cadiz Inc. only owns alternating one-square mile sections—with federally-owned lands (Sizek 2021). Cadiz Inc holds rights to the water underneath their lands, and they hope to sell their water to the California coast, some two hundred miles away. The simplest explanation of the project plan is that it would pump water out of the desert aquifer, treat it, and transport it through a pipeline to be used by water districts on the California coast.

The most recent iteration of the project, which began in 2011, would sell the water to the

Santa Margarita Water District (SMWD), in Orange County. One iteration of the project, in the map below (Figure 1), would extract the water, send it southeast through a yet-to-be constructed 43-mile pipeline along the Arizona and California railroad that connects Cadiz to Parker, Arizona. The pipeline would then connect to the California aqueduct (in light blue), and travel to SMWD's service area.

[INSERT FIGURE 1]

[CAPTION: Regional Map of Cadiz Inc proposed project. Map by Author.]

This version of the project has faced substantial challenges, primarily in the form of opposition to the pipelines that would transport water from the aquifer to existing aqueducts. During the last three presidential administrations, approvals for the project have been issued and revoked through various means: the Obama administration required additional environmental review for the pipeline, the Trump administration had promised to bring back this proposed private project as part of its infrastructure plans in 2017, and the Biden administration revoked approval for both the railroad pipeline and another pipeline proposal that would take the water through a different pipeline along a railroad northwest toward Barstow (Sizak 2018, 2021; Anderson 2022). While controversy over the pipeline might delay the project, Cadiz Inc maintains rights to extract the groundwater despite widespread criticism.

During my twenty-four months of ethnographic fieldwork in the California desert from 2015-2020, I never found any desert-dwellers—other than those employed by Cadiz Inc—who liked the project. In my interviews and participant-observation with Native American tribes, local historical societies, environmental nonprofits, and dirt bikers, I was surprised to see how Cadiz Inc's opponents otherwise spanned the gamut.ⁱ Trump supporters, libertarians, regulationists, and environmentalists all shared the sensibility that something was wrong with this project. The expression was crystallized in a phrase I heard repeatedly while doing fieldwork: “they want to take water—from the desert?!?!?” At the most basic level, taking water from an arid landscape seemed illogical. To observers like Mike, who were suspicious of corporate interests in the Mojave Desert, the revival of the project seemed like a corrupt alliance

between the federal government and the Cadiz corporation, a theory known as regulatory capture. MDLT and other environmental groups had long opposed the project, claiming both that it was unethical to drain a desert aquifer for the benefit of a city, and that the project would endanger local flora and fauna by decreasing the water table near an important spring.

This article concerns the legal and social imaginaries of groundwater extraction, and how a project that seems to defy common sense remains alive under California groundwater law. I argue that the life of the project is not fueled by corruption, but rather by *regulatory alchemy*, a concept that describes how companies create something from nothing in their environmental processes to portray their projects as both scientifically sound and financially investable. Regulatory alchemy draws attention to the regulatory processes that govern many contemporary environmental projects and, more specifically, to the way that they create narrative understandings for how one might extract wealth from nature. In this case, water and the water cycle become investable through laws and regulations specific to the property rights in California groundwater law. Cadiz frames their frame subsurface riches in terms of the temporality of natural processes.

My use of the term alchemy is inspired by geographer George Henderson (1999, xi), who analyzes nineteenth-century California novels as bourgeois attempts to theorize agricultural economies. He claims that fiction is a “densely expressive outlet for the expression of alchemic desires” that capitalists use, even as they may not be able to transform nature into capital. I build on Henderson’s analysis by reading films and environmental compliance paperwork as means for envisioning how nature might become money.

Alchemy is a particularly potent metaphor for considering groundwater in an era of water speculation and privatization. Groundwater is famously hard to measure accurately, making the promise to sell groundwater difficult to translate into profits (López-Vera 2012). But alchemy is relevant in another sense: financialization is a kind of “modern alchemy,” as former Chairman of the US Federal Reserve Paul Volcker (“Restoring the Economy” 2009) put it. While this was true for the housing market in the lead-up to the 2008 financial crisis, water is also subject to privatization (Bakker 2010) and financialization (Bayliss 2014, Loftus et al 2019). Like other large infrastructure projects, water has become financialized as companies theorize households as

future revenue streams that offer safe returns (Loftus and March 2016). In Southern California, the 2011-2017 drought also pushed water districts seek to diversify their water sources to prepare for future scarcity (Randle 2021). As I argue, Cadiz Inc has always viewed its water as a future revenue stream and financial asset. Yet, groundwater needs not even be sold to make the project work: the promise of the project is that there will be a backstop when Southern California goes dry. Cadiz Inc's profits likely depend on shorter-term financialization to remain in business today,ⁱⁱ but they also depend in the long term on the aquifer and the water in it. By pointing toward regulatory alchemy, I reveal how companies portray their projects to investors, regardless of whether their narratives are successful at attracting money to their projects.

Alchemy also implies that the myriad transformations—of groundwater into scientific estimates, and both of these into Cadiz Inc's future profits—might not work. That is, the process of regulatory alchemy that I describe in this article might fail. The models of nature that Cadiz Inc creates and I describe are necessarily imperfect, as are the myriad documents that they produce to are imperfect copies of reality (Riles 2006). Their documents, rather than pure fact, are arguments that reveal struggles for power.

Cadiz Inc's water appears as a set of easy-to-read numbers in Environmental Impact Reports and Securities and Exchange Commission (SEC) filings. For this article, I reviewed all of Cadiz's publicly available SEC filings from 1983-2020 (focusing on 10-Ks), the Environmental Impact Report for the two most recent iterations of the project, public comments on the project, public lawsuits against the project, studies of the region's hydrology, newspaper articles, and archival materials in local historical societies. These materials allowed me to understand the history of the project and how, I argue, Cadiz Inc has attempted to enact the alchemy of capital. Here, I follow nature-society geographers and environmental anthropologists who examine how legal and regulatory regimes produce ideas of nature. Environmental impact reporting processes are sites of complex struggles for power and knowledge, as shown both in large and small-scale mining projects (Kirsch 2014, Li 2015, Spiegel 2017). Environmental impact reporting also contains a struggle over the scale of analysis, an issue particularly relevant for slow-filling aquifers (Andrews and McCarthy 2014). For the Cadiz project, the temporal and geographical scales of the project are at stake in regulatory documents as is the nature of

property.

After briefly describing the history of Cadiz Inc as one of trying to turn nature into capital, the article proceeds in three parts. First, I use two films to envision how Cadiz Inc extracts desert water. *Chinatown* (Polanski 1974) is examined as a means through which desert dwellers examine the Cadiz project, but I argue that the better means of approaching imaginations of Cadiz Inc's groundwater wealth is Paul Thomas Anderson's (2007) *There Will Be Blood*. I then turn to the specifics of California groundwater law that underlie the possibilities of Cadiz Inc's profit-making, arguing that what is precisely so strange about the Cadiz case is how it is legally permissible within the confines of California groundwater law. Rather than a conspiracy, Cadiz Inc's proposed project is an example of how water regulation is supposed to work. Finally, examining representations of underground wealth in Cadiz Inc's environmental impact reporting, I argue that the potential success of the project—how Cadiz Inc could make money from natural resources—comes not from locating and extracting resources, but rather from speculating as to how much groundwater recharge there will be in the future, and representing this future water in regulatory documents. This is regulatory alchemy, how ideas about nature are created in environmental compliance documents to make a project appear profitable and keep the project alive.

I begin with the history of the Cadiz project that has yet to result in a successful sale of water to the coast. At least ten thousand pages of environmental reporting, scientific study, and investment have not, after nearly forty years, resulted in a successful water project constructed.ⁱⁱⁱ Their current stock prices and revenues as a publicly-traded company come from their plans and the speculative economies of water in California.

The Plan

In 1983, financier Keith Brackpool and geologist Mark Liggett founded Aridtech (now known as Cadiz Inc) with new technology, capital, and a dream. Water was ripe for private investment after the 1977-1978 drought, and new satellite imaging had revealed what looked like a hydrologically disconnected aquifer in the middle of nowhere that had never been commercially pumped (Aridtech Inc 1987).^{iv} The Fenner Valley Groundwater Basin underlays approximately 454,000 acres of land. The vast majority of this nearly half million acres was

owned by the federal government, but a small percentage was privately held as a result of the railroad that traverses the lowest part of the basin, where the water from the surrounding mountains pools into a dry lakebed. Near the bottom, a small town named Cadiz was a railroad water stop in a string of alphabetically named towns, the ABC towns. By the time Brackpool and Liggett arrived, however, all of the ABC towns had largely de-populated after I-40 was built in the 1950s, bypassing Route 66 (Sizek 2021). The few people who visited the ABC towns were Route 66 tourists, or those desperate for gas between Needles and Barstow.

The new company bought 30,000 acres in the area between 1983 and 1986, but they were not contiguous: Cadiz Inc owned every other section, while the remainder were owned by the federal government (see land ownership in Figure 1). In any case, the property lines were only visible on the map, and not on the ground. The land that Cadiz Inc bought was part of a flat, wide basin that is bounded by distant mountains, a salt mining operation (owned by the redundantly named National Chloride Company of America), and the Cadiz sand dunes.

Cadiz Inc's SEC filings from that time list a dizzying number of names in joint ventures, corporate takeovers, and subdivisions (Aridtech Inc 1987). The company's different names and projects reveal how corporations hedged bets and sought short-term gains through dividing their ventures during the 1980s (Ho 2009; Lazonick and O'Sullivan 2000). The first company listed, the Olenellus Group—the name derived from a trilobite that once inhabited North America—reflects the focus of the company on geologic exploration, while Aridtech, the umbrella organization dedicated to water development, bought them out after the entity seemed commercially successful (Aridtech Inc 1987). Shortly thereafter, Aridtech formed the Cadiz Valley Development Corporation, which held the lands that Pacific Agricultural Services would farm (citrus orchards and vineyard), using groundwater from the aquifer below (Aridtech Inc 1987, Cadiz Inc 2007). While the style of splitting corporate enterprises was a popular strategy, each of the enterprises represented a mode of extractive capitalism in Southern California: mining, agriculture, and water. Each, too, offered a way to envision the transformation of nature into capital.

Since the mid-1990s, Cadiz Inc has pursued groundwater extraction as the basis of all of their operations, even as they continue to hold a small farm. As Mike argued, however, their

farm is not much more than a front: in their SEC filings in the 1990s, Cadiz framed their purchase of raisin giant Sun World not as an agricultural acquisition, but instead as a means to get groundwater (Sizek and Stringfellow 2018). Though they publicly framed their project as agricultural to touring visitors, it was always about groundwater.

Cultural Understandings of the Cadiz Project: The Cinema of Extraction

Mike's suspicions about Cadiz's farm were warranted, and many others found Cadiz Inc's operations to be suspicious. Throughout my ethnographic research, *Chinatown* (Polanski 1974) was a common reference for what was wrong with Cadiz, and, more broadly, water politics in California. My interlocutors in the Morongo Basin, Needles, and on the Chemehuevi Reservation saw the film as a means to understand Cadiz Inc's project and potential profits through a lens of unfair country-city relationships, collusion between government and private companies, and the politicization of water provision in California. While *Chinatown* captures the social understanding of the project as corrupt, I argue that such a focus on corruption or immorality distracts from the real problem at stake in the Cadiz project, for which I turn to *There Will Be Blood* (Anderson 2007). I argue that *There Will Be Blood* offers a perfectly legal—but morally corrupt—strategy that defines California extractive politics.

In *Chinatown*, which was inspired by the Owens Valley water wars, the intersection of water and real estate is at the center of a noir setup. A mysterious cabal drains reservoirs to make farmers sell their land at artificially low values, allowing land speculators to purchase the prime land in order to sell it to pipeline builders. Film scholars and historians have argued that the film is a poor stand-in for the actual construction of the Los Angeles Aqueduct (Andersen 2004; Erie and Brackman 2006), but the film's shortcomings as historical docudrama and its problematic director have not undermined the resonant truth of the film (cf. Lepselter 2016). In interviews and participant-observation, my interlocutors used the film as proof that something is strange when municipalities, companies, and real estate are entangled in water transfers. Frequently, I would briefly explain the Cadiz project to someone who hadn't been following the news, and they would return with the rhetorical question "like *Chinatown*?"^v

The ubiquity of *Chinatown* references among desert dwellers reflected how the movie resonated with their experiences, including the country-city relationship (Williams 1973). While

many critics of the project—including environmentalists, local historians, and politically-engaged citizens—had nuanced critiques, even those who hadn't heard about the project before discussing it in a public event or an interview would quickly form an opinion. At the “Water in the Desert” event mentioned in the introduction, for example, many attendees hadn't heard of the project before attending, but afterward their views were set against it. The Cadiz project was about California coastal elites who were taking advantage of the desert by “stealing our water,”^{vi} as one Chemehuevi tribal member told me, without considering the effects of this project on local ecology and people. One ABC town resident summarized what many others told me, mentioning that groundwater extraction would fill the swimming pools of rich coastal dwellers, fulfilling “the wants of many” to the detriment of “the needs of a few.”^{vii} This critique came easily because it was already a familiar narrative: Desert locals frequently complained that corporations and “city people” thought that the desert was a wasteland where socially and environmentally degrading projects like nuclear waste dumps and solar projects could happen without consequence (Kuletz 1998; Voyles 2015). A quick reference to *Chinatown* offered a means of expressing how desert-dwellers thought that the project was being controlled in the city without their input.

Chinatown also reflects desert residents' sense of the collusion between government and private interests. Originally released in the era of Watergate, the Vietnam War, and the rise of environmentalism, the film reflected the growing sensibility that water provision was no longer a technical problem of getting water from one place to another, but a political problem (Gottlieb 1988). While local water users, elected officials, and the water bureaucracy used to be united in an “Iron Triangle,” this trust was broken (McCool 1994). Water users soon argued that municipal and federal water agencies were ‘captured’ by private interests (Selznick 1949). Decades later, some environmentalists extended this critique to nascent environmental compliance companies meant to satisfy demands for increased environmental regulations (Cotgrove and Duff 1981). “It all ties together,” one environmentalist told me, hinting that Cadiz and the government were colluding to make the groundwater project work against the wishes of locals.^{viii} Others told me that the company promoted “fictitious science” to meet their ends, bypassing the appropriate processes.^{ix} In contrast to corporations, locals refused to be captured: for example, a resident of a

small town some thirty miles from Cadiz told me that the company couldn't "buy [him] out."^x And indeed, what *Chinatown* signaled, for those who used it as a critique of the Cadiz project, was that something was wrong with government and capitalism when it seemed easy for a city company to take water-- "from the desert?!?!?"--to the California coast.

Chinatown's metaphors show why the project feels like such a betrayal to desert dwellers. Simply put, it is a noir rendering of desert-dwellers' experiences. Yet, the film remains a surface-level analysis of the project, and one that fails to investigate the underground worlds of the aquifer. The aquifer and the profits to be made from it, I argue, are better understood through *There Will Be Blood* (Anderson 2007). *There Will Be Blood* is based on Upton Sinclair's (1927) *Oil!*, a labor-oriented rendering of the Teapot Dome scandal, in which petroleum companies bribed government officials to be granted leases to oilfields in Wyoming and Southern California at artificially low rates and without competitive bidding. The film, I argue, offers a vision of capital and wealth that has now become the domain of environmental impact reports.

In the film, Daniel Day-Lewis plays the fictional Daniel Plainview, a former silver miner who becomes an oilman. After greasing the palms of local officials to gain access to the oilfield and purchase the land above it, he drains the oil field and becomes fantastically wealthy.^{xi} At the end of the film (spoiler alert!), his nemesis Eli offers to sell him the last property in the oil field. In return, Plainview reveals that he has already extracted the oil underneath it, using the metaphor of a milkshake and an extraordinarily long straw: "My straw reaches acrooooooss the room, and starts to drink your milkshake. I drink your milkshake! I drink it up!" Plainview's pronouncement—that he has gotten all of the oil from the underground field—seems to suck the life from Eli. The film ends with Plainview killing Eli with a bowling pin in his mansion's bowling alley, the scene referencing his excessive oil wealth accumulated at the expense of his morality.^{xii} The film offers a way of envisioning wealth from an oilfield, but admittedly in a way that reinforces early twentieth-century extraction practices: it is real oil being extracted and sold. But, another aspect of it is just as revealing: Plainview is a rapacious and immoral capitalist, even as his oil extraction is perfectly legal.

Plainview's oil rigs extract an underground pool of oil shared among many properties, including the one that he does not purchase. Like an oilfield, aquifers are often shared among

many aboveground owners who can each lay claim to the groundwater beneath them. If one owner thinks that the others has taken more than their fair share, they can sue them through a process called adjudication (Sax 2003). In the adjudication process, a judge divides the groundwater in the aquifer, apportioning some to each overlying landowner according to the proportion of their aboveground ownership (Sax 2003). In so doing, the court attempts to make what is often described as an “invisible resource” into a visible and divisible one (López-Vera 2012; Hundley 2001). Through dividing water among landowners whose lands overlie the aquifer, adjudication resolves what seems secret into clearly delineated amounts through what Emily Brooks (2017) calls “number narratives”: an estimate of how much groundwater is left, how much pumping is in excess of recharge rates, and how much time overlying owners have before they run out. These new numbered realities come to structure the lives of overlying owners, forcing new social relations between them when aquifers are overdrafted (Gray and Gibson 2013). In a place like California, where up to fifty percent of water use is from groundwater (López-Vera 2012), groundwater regulation could dramatically change lives.

As in *There Will Be Blood*'s oil fields, renegotiating relationships between aboveground owners often happens too late, after an overpumping “crisis” (Sax 2003, 274). In California, crises have historically been solved aquifer by aquifer, as adjudications took place only after one overlying owner sued another. This patchwork of adjudication, with some aquifers adjudicated and others not, was supposed to be solved through the 2014 passage of the Sustainable Groundwater Management Act (SGMA), which was intended to force the adjudication of overdrafted basins across the state (Owen et al 2019). While SGMA applies to many basins in California, its jurisdiction does not extend to low-priority basins like the Fenner Basin, where the Cadiz project lies and where the other lands overlying the aquifer are owned by the federal government (State of California, n.d).

The adjudication process frames the solution of the overdrafted aquifer as one of property: that is, the solution to overdraft considers *how much* water each party gets. This solution, premised in a neoclassical approach to property, requires “necessitating ‘king-philosophers’ or ‘goddam bureaucrats’ to define and adjust property rights to commodity conditions, while at the same time rejecting the interference of public involvement” (Emel,

Roberts, and Sauri 1992, 47). The problem this solution presents—in which both an authoritative voice must determine the proper allocation of resources and such an authoritative voice is distrusted by the public—is at the crux of the real political scandals on which both *Chinatown* and *There Will Be Blood* are based. In both, corrupt officials and private interests work together against the interests of the public rather than fairly applying the law. Further, this view presents the conundrum that both Cadiz Inc and its opponents face: that, in the search for answers, no one trusts the authoritative voices that purport to know how much water is in the aquifer or how much water can be taken out.

Mistrust is at the center of both how local residents understand the project, and what seems to be the trouble with Cadiz Inc's project (Sizek and Stringfellow 2018). Yet, the scheme for company's profit comes not from collusion or corruption, but instead through legal and regulatory underpinnings in groundwater law that make *There Will Be Blood's* milkshake possible. By turning away from the accusations of political corruption that have plagued the Cadiz project, I seek to understand how California groundwater law frames its relation to surface ownership. This points to the way that projects like Plainview's oil rigs or Cadiz Inc's planned pumps—though perhaps underpinned or influenced by corruption—are perfectly legal means to produce nature to make money.

Making Money from Groundwater: Property, Surplus, and Profit

The right to groundwater in California is a property right in which ownership of the overlying land grants rights to the water beneath (Gardner, Moore, and Walker 1997). In the adjudication process, this property right in water is divided among the overlying owners, each of whom are given their own portion of the groundwater as long as their proposed uses meet certain criteria of beneficial and reasonable use. Unlike oil resources, in which underground resources are somewhat finite (Bridge 2010), groundwater can recharge, though the rate of groundwater recharge is highly variable. In other words, while groundwater may be pumped out, it also re-enters the aquifer through percolation. As a result, the goal of most groundwater managers is to ensure that the rate of extraction does not dramatically exceed the recharge rate, so as to prevent irreversible effects of overdrafting the aquifer, which include land subsidence and water contamination (Sax 2003, 302). As Karen Bakker (2010) argues in her analysis of water

privatization, specific properties of water shape how it enters the market. Here, I argue that the groundwater recharge—and the way that it shapes total groundwater amounts—is central to the success of Cadiz Inc’s strategy.

California’s groundwater regulations make future groundwater legible through aquifer recharge, and therefore frame groundwater as a temporal form of property. In this reading, water is akin to land, whose value as a fictitious commodity comes from future rents (Harvey 1982) and infrastructure, in which long-term future revenues are used to justify contemporary debt and expenditures for an increasingly privatized sector (O’Neill 2013, Loftus and March 2016). Like predictions of peak oil or commodity futures, assertions about the water cycle are not about how much water there is, but how much there will be. This future water—which exists on paper—becomes an investable object, or how local water becomes part of a flow of transnational capital (Swyngedouw 2005). In regulatory alchemy—the process through which Cadiz Inc imagines groundwater processes in their environmental impact reporting under CEQA—the temporality of groundwater and recharge in the water cycle become central to the Cadiz project.

The financialization of future water emerges from California groundwater law, which began its modern era with *Katz v. Walkinshaw* (1903). In this case, the California State Supreme Court case determined that groundwater was a correlative right, in which overlying owners have a property interest in the water below (Blomquist 1992). But this right is not unlimited: the California Constitution delimits how overlying owners can use the groundwater they pump (Sax 2003). One such standard is “beneficial use,” which describes appropriate water uses and therefore delimits the reasons why groundwater can be taken out of an aquifer. Beneficial use defines water use in terms of human activity, including household and agricultural uses, but has been expanded to include wetlands or environmental uses (Cantor 2017).

Reasonable use was a standard added later to further restrict beneficial use, and judges whether the method of water use is efficient or excessively wasteful (Cantor 2017). While beneficial use is a more stable category, reasonable use changes with the adoption of new technology (Emel and Brooks 1988). For example, some have argued that older methods of irrigation—like flood irrigation—should be considered unreasonable once newer methods become widespread (Wilson 2011). Even as reasonable use shrinks and water use becomes more

efficient, the amount of groundwater that could be appropriated remains the same. Following geographer Alida Cantor (2017, 1208), the question is who “is entitled to the savings?”

These “savings” become “surplus,” in the language of California groundwater law. In *Los Angeles v. San Fernando* (1975), the California Supreme Court defined surplus as “when the amount of water being extracted from it is less than the maximum that could be withdrawn without adverse effects on the basin's long term supply” (quoted in Weber 1994, 681). Surplus is when more water can be withdrawn than the beneficial and reasonable use amounts—that is, when more water percolates into the aquifer each year than can leave it using the other standards. What can be withdrawn without adverse effects is often known as “safe yield.” While this is the legal definition of groundwater use, it is scientifically unintelligible to hydrogeologists who find the term to be an oxymoron because there is no scientific basis for determining safety (Weber 1994). In this reading, surplus is already a scientific and legal category, one that combines ideas of how much water one *should need* with a scientific idea of how much water will be in the aquifer.

Unlike beneficial or reasonable use water, surplus water does not need to be applied to the land above. Instead, it can be appropriated for other uses and sent elsewhere, as was popular in projects proposed after the 1976-77 drought. Often considered the first major drought of the modern era, the California drought of 1976-1977 was so severe that the State Water Project, which provides much of the water to the Central Valley, could not provide all of the water it had already contracted to its users, and agricultural and municipal users had to accept substantial cuts of 60% and 10%, respectively (Santos and Godwin 1978, 39). As farmers and municipalities contended with the loss of water available to them, they turned to groundwater as a temporary solution to their surface water shortages.

“In a drought, groundwater is like money in a bank,” lawyer Gregory Weber wrote (1994, 658). Though Weber was referring to the way that groundwater accumulates over time, water speculators took this statement much more literally. In 1977, water speculators saw an opportunity in the drought, and a new crop of speculators started buying agricultural land in the Central Valley not to farm, but instead to gain rights to the groundwater underneath the land with hopes to sell it to thirsty municipalities for high returns rather than use it on agriculture (Green

2012). They relied on the transformation from beneficial and reasonable water to “surplus” water to be sent elsewhere. In the early 1980s, new legislation eased barriers to transfer water between districts, reinvigorating water speculation (Gaffney 1997). The hunt for groundwater to transfer continued during the 1980s, as groundwater-rich areas exported water (Weber 1994).

Cadiz Inc was one of these investors. Then known as Aridtech, Cadiz Inc started their project in the Mojave Desert in 1983, and they situated their plans for profit in a hydrologically disconnected aquifer under the desert floor.^{xiii} Their plan was to purchase the land above the aquifer, obtain groundwater rights, and later sell the surplus water that they had been keeping “in storage” (Santa Margarita Water District 2011). In short, it was a speculative venture premised in the pricing of future water in comparison to what they paid in 1983. Their claim to groundwater was enhanced by property law, as the other major overlying owner of the land was the federal government, an entity that rarely pushes for their groundwater rights.^{xiv}

The initial premise of Cadiz Inc’s profit, then, was based in the legal and regulatory frameworks of California groundwater law, which define groundwater extraction not only through property rights, but the through understandings of the temporalities of groundwater. In the following section, I discuss how Cadiz Inc frames its own project as potentially profitable through trying to increase the amount of surplus water available by examining their SEC filings and environmental impact reporting to trace their regulatory alchemy.

Regulatory Alchemy: How Natural Processes Become Money

Cadiz Inc’s potential profits and investor pitches depend on how much groundwater they can take out of the aquifer that underlies their property, or, in the language of California groundwater law, how much of the water is surplus. As discussed earlier, surplus can come from decreasing water ‘waste’ or from increasing estimates of groundwater recharge, both of which increase the amount of groundwater available. Therefore, numbered projections of groundwater recharge, made in regulatory documents like Environmental Impact Reports, are a key part of the baseline that determines the Cadiz Inc’s future profits, and how they sell their company in public reports like SEC filings. These regulatory documents are both audits, in which public agencies judge claims Cadiz Inc makes (Power 1994), and narrations of profit that reveal the corporation’s understandings of natural processes. In examining these documents, I draw on critical

approaches to SEC filings and environmental impact reporting (Maurer and Martin 2012, Spiegel 2017) as a means to understand how Cadiz Inc sees their project as an intervention to solve a problem in the water cycle.

Environmental impact reporting and regulatory processes are a central component of almost any land-based project, including road-building, house construction, and extractive projects. Today, most environmental impacting is outsourced to compliance companies that conduct scientific studies and write lengthy reports to satisfy regulators.^{xv} These companies secure regulatory approval under laws like the National Environmental Policy Act (NEPA, for federal lands) and its California equivalent, the California Environmental Quality Act (CEQA, for privately held lands) (Kirsch 2014). In CEQA documents, Cadiz Inc explains the scientific reasoning behind their groundwater project. In SEC filings, they explain how this planned water extraction will translate into profits. SEC yearly filings are publicly available and filed with the federal agency each year, and allow a publicly-traded company to provide a basic overview of their plans for the future and outline their plans for profit to potential stockbuyers.

As seen in their regulatory documents, Cadiz Inc changed their narrative of the project from one in which nature *saved* water to one in which nature *wasted* water when they switched from a surplus-and-storage model in the 1990s to a wellfield project in the 2010s. This shift, I argue, is a narrative shift of regulatory alchemy in which they make natural processes appear inefficient in order to produce the possibility of future profits.

In the 1990s, Cadiz Inc had proposed a project that was similar to other popular initiatives at the time: they would use the aquifer as underground storage for Colorado River water during years of surplus flow (Kletzing 1987). During years of excess, Colorado River water would be piped into the aquifer, and later would be taken out during years of drought (Cadiz 2007). In this model, the profit from the project came from what the company framed as the advantages of “storing” water in an aquifer underground rather than in a surface-level reservoir (Cadiz Inc. 2007, 2). They claimed that aquifer storage would prevent contamination and minimize evaporation. The water from times of surplus would be available during later times of dearth, what might be called “strategic water stockpiling” (Randle 2021). When water prices increased, they would be able to sell the water for more money than they had initially used to

buy the land. The underground bowl, or aquifer-as-storage, model that the company envisioned was like other framing of nature as infrastructure (Ballesterio 2019). However, this 1990s iteration of the project failed when the Los Angeles-based Metropolitan Water District (which had been contracted to receive the water) decided that the project was too expensive and politically sensitive to support in 2002.^{xvi}

For several years after the 1990s iteration of the project failed, the company continued to frame the value of the project and its plan through the advantages of the aquifer as an underground bowl. However, in 2010, they changed their narrative: they stop referencing how the aquifer prevents the evaporation of stored water and no longer claim that the aquifer-as-storage model prevents water loss. Instead, they argue that aquifer and its natural processes *wastes* water that the project would *save*. Water in the system, Cadiz Inc says in their 2010 SEC filing, is “presently being *wasted* to evaporation at the Bristol and Cadiz Dry Lakes” (3, emphasis mine). Whereas before, they claimed that the aquifer was saving water by preventing evaporation that is part of a reservoir storage system, this new reading articulated the aquifer was wasting water, as documented in a new report from CH2M Hill, an engineering and environmental compliance company. The new report, released officially in July 2010, was already in the hands of Cadiz Inc officials when they were filing with the SEC in March.

This switch—from the aquifer as storing water to wasting water—is both baffling and brilliant. What is the scientific claim that Cadiz Inc is making, and the narrative that the company uses to understand the aquifer as a problem rather than as a solution? On their website, Cadiz Inc uses this infographic (see Figure 2, below) to explain how water is wasted by the aquifer. In the most basic sense, this image depicts the water cycle, in which rain falls on the ground,^{xvii} runs down the mountains and into a basin, where it percolates into the aquifer, what the company had initially described as “storage.” For Cadiz Inc, however, this is a depiction of a wasteful process that they hope to engineer—by preventing and intercepting water that might evaporate by decreasing the groundwater level.

[INSERT FIGURE 2]

[CAPTION: Cadiz Inc's Diagram of Water Loss (from Cadiz n.d.a)]

While water enters into the aquifer through precipitation and collection into the watershed, water is lost from evaporation at Bristol Dry Lake, on the left side of the image. During the last Ice Age, Bristol Dry Lake was wet, but today it is a salt-encrusted surface with a high water table. The salt-encrusted surface originates from water evaporating through the crust, as the salts and minerals dissolved in the water are left behind. Immediately below the lakebed is a layer of salty brine that is located on top of the water. Through extracting water from the aquifer and lowering the water table, the company argues that it will prevent water from evaporating through the dry lakebed or becoming undrinkable by entering the brine layer. Thus, their claim to ‘capture’ or ‘intercept’ water before it is ‘lost’ to evaporation (Cadiz Inc. 2011; Santa Margarita Water District 2011) frames the existence of water evaporation as a ‘wasteful’ process. By ‘intercepting’ this water, Cadiz Inc is appropriating water that they argue would be otherwise lost to evaporation. Their estimate also increases the recharge rate for the aquifer, and thus the amount of surplus in excess of safe yield.

Cadiz Inc frames the water cycle as “wasteful” and in need of human engineering to increase its efficiency. Such an idea of nature as wasteful resonates with what scholars Valerie Kuletz (1998) and Traci Voyles (2015) have called wastelanding: the social production of desert natures and peoples as wastelands that can be destroyed without consequence. Like colonial strategies that understood nature as wasteful in order to allow for aggressive exploitation or engineering (Gidwani and Reddy 2011, Gidwani 2013), Cadiz’s framing of a “wasteful” aquifer encourages appropriating groundwater and new engineering projects. Though nearly a century later, Cadiz’s project beckons back to Progressive understandings of engineering and efficiency.

As they present a new version of the wasteful water cycle, the company claims that their project is “new, sustainable water supply for Project participants without adversely impacting the aquifer system or the desert environment” (Cadiz Inc. 2011, 46). Here, the language of sustainability mirrors that of alchemy—to make something from nothing with no adverse effects. Their capitalist dream of sustainability is used in their marketing “to be true to our philosophy of sustainability... our innovative Cadiz Valley Water Project conserves water not only by capturing water that otherwise would have been wasted to evaporation, but also by storing water with

almost no evaporative loss” (Cadiz Inc. n.d. c). Through making something from nothing—or something from a new understanding of a natural process—Cadiz recreates a new narrative about the aquifer.

Cadiz Inc’s regulatory alchemy is most visible in their documents that estimate groundwater recharge. Their estimates drastically differ from all others for the region. A 2012 letter from the Mojave National Preserve, a National Park Service unit near the Cadiz project and one of two federal entities that owns the majority of land overlying the Fenner Aquifer, reveals the vast discrepancy in a chart that lists the recharge rates found by different investigators (Dubois 2012). The chart features columns of estimated recharge rates: investigators who had been funded by Cadiz Inc, and all other investigators, which include academic hydrologists and the federal government. The range of estimates for recharge rates differ dramatically across the two groups of investigators, averaging 4,100 acre-feet/year for studies by non-Cadiz Inc investigators to 30,500 acre-feet/year for those made by investigators funded by Cadiz Inc. This dramatic difference leads then-Mojave National Preserve Superintendent Stephanie DuBois to write in an official CEQA letter that the company’s “estimates of the annual recharge (and discharge) for the Cadiz project watershed in the range of 30,000 AFY are not reasonable and should not even be considered” (3). The “not reasonable” rates are likely because Cadiz Inc has a financial stake in the success of the project, unlike the National Park Service.

Cadiz Inc’s estimated recharge rates, which were approved in July 2012 under CEQA, are nearly ten times greater than any other investigator, and these different recharge rates allow for dramatically different pumping rates. As part of the 2010s iteration of the project, the company plans to take 50,000 acre-feet per year over a fifty year period, resulting in a drawdown of 975,000 acre-feet from the aquifer if the recharge rate is 34,000 acre-feet a year. In contrast, if the recharge rate is the much lower 4,100 acre-feet/year, then the aquifer would lose around two and a half times that water: 2,295,000 acre-feet. Environmentalists fear that this much greater drawdown could have irreversible effects on springs that may share the aquifer with Cadiz Inc as well as other negative environmental impacts (Zdon et al 2018). While environmentalists have challenged the project in its multiple iterations through the California Environmental Quality Act (CEQA) process, these challenges have remained unsuccessful (Coon 2016). For Cadiz Inc’s

project, these numbers make a big difference: their larger estimate will allow them to make greater profits based on the water they can sell.

These dramatic differences in number narratives (Brooks 2017) reveal more than the financial interests of Cadiz Inc. Their new water comes from a change to the water cycle's temporality made possible through their influence over the regulatory process. But it does more than that: their new theory makes natural processes into capital, as the recharge rates are a water multiplier. Like capital, Cadiz Inc's water calculations seem to magically multiply, making a small amount of water into a larger one. While such calculations allow them to sell more water in the future, they also help Cadiz in the present: they allow the company to create more assets against which to balance their loans. In 2013, their senior lender MSD Credit increased their secured debt facility from \$30 million to \$40 million (Cadiz 2013). That is, Cadiz Inc could continue to gain access to more capital precisely because they could recalculate the value of their assets, both because of the favorable CEQA decision and the paper water it contained.

Cadiz Inc's story reveals how the process of regulation is as alchemical and narrative as it is scientific, bound both to environmental compliance and financial reporting. Such a transformation of nature into money, I suggest, is not only about number narratives that make a project seem feasible, but about the construction of time and cyclical natural processes in which natural processes—both in their advantages and disadvantages—become a source of capitalist gain.

Conclusion

In this article, I began with the common view of Cadiz Inc's groundwater project as a *Chinatown*-type conspiracy, tracing how the country-city politics embodied in this critique captured the feeling of what the project would do to the desert while distracting from the perfectly legal underpinnings of the Cadiz project. Then tracing the legal means that Cadiz Inc uses to make its project work—from the California court's interpretations of beneficial and reasonable use to the company's environmental compliance paperwork—I argued that Cadiz Inc's planned road to profit is regulatory alchemy. Encompassing how legal and financial documentation remakes understandings of natural processes, regulatory alchemy shows how portrayals of nature underlie potential profit, much like how films and novels have done so in

popular culture. Cadiz Inc’s alchemy—both the regulatory documents that make tangible their plans to make profit from groundwater and their depictions of the water cycle that make water appear as ‘wasted’ in the water cycle—is made through a scientific depiction of nature and the temporalities of natural processes, not through collusion between government officials and water barons. The planned source of Cadiz Inc’s profit is depictions of nature in regulatory documents.

Regulatory alchemy, then, considers the relationship between state, science, and profit both inspired by and distinct from the ways that alchemy is used to describe dreams of capital accumulation from nothing or through some form of corruption or collusion. Rather than a *Chinatown* corruption story, this is about the underground riches imagined in *There Will Be Blood* in which property regimes enable capital accumulation alongside regulation, except the cinematic dreams of wealth are made through environmental compliance processes. This alchemy is about producing the ideas of endless surplus water to appropriate, manufacturing plenty for times of dearth. Their regulatory alchemy has produced endless water during a drought, but can it produce endless investment? While the success of Cadiz’s attempted alchemy for their future profits is yet to be realized in a completed water project, their documents show how they imagine the futures of water in the California desert. In this way, regulatory alchemy helps to move beyond allegations of fraud, instead asking about the specificity and materiality of what is being regulated, and how exactly science, profits, and the state are made through regulation.

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- i Methodological endnote: These participants were identified through their participation in local and public land use issues, the primary focus of my research. During my years of ethnographic research, I discussed the Cadiz issue with over 100 research participants, primarily those living in the East Mojave or Morongo Basin. This included people from the following groups: employees and volunteers for local environmental and Native American organizations (primarily including members of Cahuilla and Chemehuevi tribes), Sierra Club CA/NV Wilderness meeting attendees, federal employees, individuals who attended public hearings on local issues, Copper Mountain Community Center users, Adopt-a-Highway volunteers, volunteers at local historical societies, hikers and tourists in Joshua Tree National Park, Desert Institute class participants, scientists and hydrologists, and off-highway vehicle users. While my research at the time was not focused exclusively on the Cadiz project, interviewees often brought up the topic without prompting, or brought up other water-related issues which led to conversations about the project.
- ii Cadiz's financial records (10-K yearly filings) from 2006-2011 indicate that their primary proceeds come from sale of stock and issuance of loans. During this time, they operate at a net loss on their operating expenses (including the farm). While this certainly indicates a form of financialization of the company—that they are only making money on the stocks and investments rather than in their actual operations—this form of profits is at odds with another key component of financialization: shareholder value (see Lazonick and O'Sullivan 2000). In their 2012 10-K, Cadiz states that they “have not paid a cash dividend on our common stock and do not anticipate paying any cash dividends in the foreseeable future” (15), and they also have not participated in stock buybacks to increase shareholder value. Finally, in analyzing their assets during this time period, their tangible assets—land, plants, equipment and water—constitute between 70% and 78% of Cadiz's reported total assets. In the above analysis, I followed the three measures of financialization from Soener 2021.
- iii The most recent iteration of the project totaled more than 4,300 pages for the Environmental Impact Report alone (SMWD 2011), and previous iterations of the project have also required environmental impact reporting and additional scientific study.
- iv This point has been contested in other studies of the area. See Zdon, Davisson and Love 2018.
- v Emily Green's (2016) commentary also demonstrates how the project's imaginary has been tied to *Chinatown*.
- vi Talk at Ward Valley Celebration, February 2018.
- vii Interview, August 2015.
- viii Interview, December 2017.
- ix Environmentalist interview at Sierra Club Meeting, February 2018.
- x Interview, August 2015.
- xi The novel opens with a depiction of the road as the central infrastructural metaphor. Today, perhaps a pipeline or sprinkler would be more appropriate.
- xii In *Oil!*, however, the central conflict of the book is the “disharmonies between capital and labor” (Sinclair 1927, 163), the relationship between J. Arnold Ross (the father of the main character) and his oil workers.
- xiii The promise of disconnection is very important for ensuring that it is harder for others to make claims on the water. While outside of the scope of this article, there is contestation about whether or not the aquifer is connected to other regional water sources. Environmentalists have argued that Bonanza Spring, a local oasis for wildlife, is connected to the aquifer Cadiz plans to pump (interviews, 2018; see also Zdon, Davisson and Love 2018).
- xiv Interviews, Frazier Haney and David Lamfrom, 2018.
- xv Cadiz lists six EIR authors: Environmental Science Associates (main author), RBF Consultants, CH2MHill, Paleo Solutions, Inc., Circle Mountains Biological Consultants, Inc, and GEOSCIENCES Support Services, Inc (Santa Margarita Water District 2011).
- xvi One of the political scandals that directly implicated the project was a finding that Cadiz owner Keith Brackpool had been a major supporter of Governor Gray Davis, who was wrapped up in other scandals (Clifford and Perry 2000). Similarly other California desert projects in the 1990s were stalled due to corruption, including the proposed Bolo landfill near Cadiz (Carraher 1998).
- xvii The infographic also misleads by implying that it snows in the Marble and Ship Mountains, which is quite rare.